WASHINGTON
SCIENCE TRENDS

HIGHLIGHTS

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* CIVILIAN DEFENSE PROGRAMS

The Defense Department's civilian defense plan will include a number of features of interest to technically-oriented organizations in addition to the well-publicized plan for group or community fallout shelters. Some of these will include:

✓ Emergency Communications Facilities -- The Federal Government is encouraging state and local authorities to plan for emergency operating centers and will match, dollar for dollar, the cost of emergency communicating facilities between such operating centers.

✓ National Warning System -- The present federally-operated national warning system (NAWAS) carries the warning signal to state warning points. Responsibility for transmitting such a warning to local warning systems, and from there to the general public, will continue to be a state and local responsibility. However, Federal matching funds will be available for both administration and equipment. The same system will provide for any special warning systems for particular state and local public officials.

✓ NEAR System -- The Office of Civil Defense believes that the NEAR warning system is "feasible from the engineering standpoint" and is examining the problems of installing such a system on a national scale. (The NEAR system operates through signal generators placed in the electrical power grid. These generators are actuated directly by the national warning system, and in turn actuate buzzers plugged or wired into home electrical circuits.) No decision has yet been made as to allocation of responsibilities for system operation. However, it has been decided that state and local governments will be responsible for a supporting public information program explaining the nature of the system and the "appropriate response to a signal." The Federal Government will provide information and technical assistance to state organizations in carrying out their responsibilities.

✓ Radiological Monitoring Systems -- The Federal Government is supplying radiological monitoring stations with radiation detection equipment, and is supplying instructor training in federally-operated schools. By next Spring there will be approximately 50,000 such stations. The new civil defense program contemplates increasing the number of local monitoring points to 150,000 -- and moving these monitoring points into selected community shelters, where they will be tied into a control at the local emergency operating center. (The Federal Government maintains a separate detection network of some 1,000 stations for central damage assessment purposes.) Establishing and operating the local monitoring points will continue to be left to state and local authorities, subject to inspection by Federal authorities to assure that federally-owned monitoring equipment will be properly used by trained operators.

* ARMY RESEARCH PROBLEMS (Continued from WST, December 11, 1961)

□ QMC - 25 -- Devise practical method(s) of unitizing supplies (subsistence and non-subsistence) for shipment from the contractor's facility to overseas destinations. (A feasibility study recently completed indicates that a mandatory requirement for unit loading would find interested bidders for items of canned non-perishable subsistence; however, no studies have been made on other Quartermaster Corps supply items. Unitization of supplies at the supplier level was attempted during World War II by the Armed Forces, but lack of firm requirements in addition to the suppliers' lack of familiarity with unitization doomed the program to failure.

Problems involved are: (a) methods for stablizing loads; (b) effectiveness of load overhangs, underhangs, and solid loads; (c) determination of the value of sheathed loads; (d) containerization of supplies, determination of which items of Quartermaster supply would be effectively and economically overpacked in multiples in a master container. Palletization and containerization have been effected only at the depot level and a minimum of data exists on the effectiveness of these methods. Further industrial assistance in one or all of the following categories is needed: (1) cooperating with the Armed Forces in bidding to furnish supplies in unit loads when bids are issued requiring unitization; (2) making available to the Armed Forces information which will aid in the development of methods, patterns, etc., for unitizing supplies; (3) furnishing information of any difficulties experienced in plant storage, production, handling, and carloading if unitizing of supplies has been accomplished.)

□ QMC - 38 -- Develop an armor vest for combat personnel utilizing rigid plates as protective elements. (In order to utilize the advantages afforded by rigid materials, such as metals and laminated plastics (as compared to flexible materials such as fabrics) in providing resistance to penetration by fragment type projectiles, a flexible structure of overlapping plates has been designed. A problem has been encountered in the reduction of the design to practice in mounting the plates onto a supporting batting. One technique is to use an adhesive to bond the center of the plate to the batting. Although an apparently strong bond is obtained, the bonded area when subjected to ballistic impact completely fails with the result that the plate falls out of position. An adhesive or adhesive process producing a bond resistant to ballistic impact or other means of mounting the plates that will not impair the flexibility of the structure, nor unduly increase the weight of the vest, is required.)

□ QMC - 39 -- Develop a flight helmet to protect combat personnel against ballistic, acoustical, and crash hazards associated with the operation of Army aircraft. (There is no standard protective helmet for Army aircraft personnel in the supply system. A non-ballistic Navy flight helmet incorporating microphone and earphones compatible with communications equipment in Army aircraft has been type-classified as an interim standard and is currently being procured. A helmet providing protection from all three hazards (ballistic, acoustical, and crash) is needed. The acoustical hazard has been aggravated by increases in aircraft power, particularly in rotary wing power plants, with consequent increase in noise to levels injurious to hearing. Present devices (ear plugs and ear muffs) are effective in attenuating high frequency noise but are much less effective against low frequency noise. Ear muffs presently available are not compatible (i.e., compete for the same space) with helmet suspension designs providing the greatest protection to the head in the event of a crash. Mutually compatible acoustical-protective crash-protective systems are needed.)

- QMC - 40 -- Develop flight armor to protect combat personnel against high velocity ball and armor-piercing ammunition. (At present Army aviation crew members have available the M-52 Armored Vest and Groin Armor, neither of which are capable of effectively defeating high velocity bullets. There is a requirement for developing a lightweight system which will protect against enemy ball and armor-piercing missiles. The components should be designed into a detachable type Flight Armor Kit, which may be attached to the air frame of the aircraft, when needed. There is also a requirement for an Armored Seat, capable of stopping missiles fired from reasonably short ranges, to protect air crew members against missile attack through the bottom of the aircraft.)

- QMC - 41 -- Develop an armored outfit that will protect combat personnel engaged in mine clearance against the hazards of exploding mines. (The only items of personnel armor that are available to combat personnel engaged in clearing mines from a field are the standard M-1 helmet and armor vest. These protect the head and upper torso; the rest of the body is unprotected. Present designs for a protective outfit utilize these standard items supplemented by a laminated nylon cloth visor with transparent plastic inserts for face protection, a jacket liner with armored sleeves of nylon cloth worn over the vest, and nylon cloth trousers. The complete outfit, weighing 25 pounds, is currently in user test. Transparent plastics and flexible armor with greater resistance to penetration by mine fragments are required to reduce the weight of this outfit. Transparent armor plastics with scratch resistance equal to glass are needed to minimize the anticipated frequent field replacement of visor inserts. Design improvements are desirable to reduce wearer discomfort and impairment of mobility.)

- QMC - 50 -- Develop a personal heating system for use in combat clothing ensembles. (A device is needed that will generate variable quantities of heat between the limits of 0 and 600 B.t.u.; provide power for heat distribution; operate at subzero temperatures in moderate winds; permit individuals wearing the outfit to walk about, work with hands, ride or drive unheated vehicles, and be independent of appendages such as air hoses or power connections. The device should operate a minimum of 8 hours without refueling; permit rapid removal; be safe to use without creating a fire hazard, uncomfortable hot spots, or toxic fumes and be, above all, practical for use by individuals. Preliminary studies show that inventive genius is needed to produce a non-electrical system of this nature or a very light, silent, portable electrical power unit. The fuel must be high energy and, preferably, that normally available to the combat soldier. The critical safe upper limit at skin surface is less than 100° F. While the system described is the ultimate required, solutions to any part of the problem will be welcome.)

- QMC - 57 -- Develop armor materials effective against anti-personnel munitions with protection to weight per unit area ratios than those of materials presently used. (For personnel armor, the variables of weight, body area covered, and the protection provided by the armor material are most important and interrelated. Consequently, the effectiveness of armor is described in terms of protection divided by the weight per unit area. More effective materials are needed to provide reduction in weight; increase in the extent of the body area covered; and reduction in the number killed or wounded in action. The increasing effectiveness of anti-personnel munitions demands that improvements in personnel armor materials keep pace if the present level of protection is to be maintained. Improved materials are required for use in flexible, in rigid, and in transparent armor structures. A better understanding of ballistic impact phenomena is also needed for application to personnel armor materials.)

* ARMY RESEARCH PROBLEMS (Continued)

- QMC - 54 -- Develop a material for incorporation into ballistic eye armor to protect the individual soldier against dazzle effects of nuclear weapons. (The dazzle and flash-blinding effects of nuclear weapon detonations can extend to areas far beyond the zone of thermal effectiveness. The Army must provide protection within both areas to dazzle effects and also to thermal effects within the zone of thermal effectiveness.

  Dazzle and flash-blindness due to nuclear detonations can greatly reduce the operational efficiency of the soldier during a critical period of an operation and thereby seriously jeopardize the mission. The effects are particularly severe during the night. Under dark-adapted conditions, the pupil is dilated and will admit approximately 50 times more light than during light-adapted conditions. Even after the eye has recovered sufficient sensitivity to see, following a bright flash in the dark, true dark adaptation is delayed much longer.

  In view of this, a Department of the Army requirement exists for protection of the eyes against low velocity missiles and dazzle effects of nuclear weapon detonations, including thermal or ballistic protection to the eye and the skin areas immediately adjacent to the eye. The materials used should therefore be thermally stable for a sufficient time to offer thermal protection.

  The primary requirement for dazzle protection is a material capable of being incorporated in some manner into the eye armor.)

- QMC - 56 -- Develop elastomers which will provide thermal and flame protection in clothing items. (All elastomeric materials presently available contain carbon, which means that the material will burn at relatively low temperatures. Most elastomers continue to burn when once ignited. There are available several types of elastomers, such as fluorine-containing and chlorine-containing, that will self-extinguish when a flame source is removed from the elastomer. Also it is possible to compound into elastomers, by the addition of such materials as antimony chloride, the property of flame self-extinguishing. There is a great need for materials which have greater thermal stability and greater flame-resistant characteristics than are presently available.)

- QMC - 58 -- Develop new fabrics for field combat clothing. (There is a requirement for a practical fabric structure or a finish fabric combination, or system, that will be permeable to water vapor, durable, and provide adequate camouflage against detection in the visible and IR region of the spectrum. This fabric should be compatible with CBR (chemical, biological, and radiological) and thermal requirements for field combat clothing.)

- QMC - 59 -- Develop materials which protect against flame. (The problem of providing the individual soldier with protection against flame attack is an urgent one. At the same time such protection must not materially increase the weight load or decrease the wearability, from the standpoint of comfort, of the uniform. Also, the material should not produce tars, which in themselves may cause burns.)

- QMC - 188 -- Develop camouflage and deception techniques which will provide the soldier and his equipment a means of concealment, cover, and deception against electronic surveillance systems. (At present, the soldier can be protected in the spectral region out to 1 micron, but the region beyond has not been explored. The lack of protection beyond 1 micron is extremely critical because considerable work has been done on devices that detect from 0.4 of a micron out to 30 microns, and beyond. There is a need for investigating and determining the feasibility of (1) a multifunctional wide band color and finish system for textile surfaces to provide protection to the soldier in the visual photographic near and far infrared and microwave regions, and (2) phototropic and thermotropic systems for use in chameleon-like camouflage overgarments.)

□ HELIUM EXPANSION TURBINE: The National Bureau of Standards has developed a miniature helium expansion turbine in which conventional roller bearings are replaced by gas-lubricated bearings. The expansion turbine is used in the production of refrigeration at liquid helium temperatures and eliminates the need for liquid hydrogen pre-cooling of the helium, and the risk of explosion of fire associated with liquid hydrogen. NBS says the replacement of conventional rolling-element bearings with gas lubricated journal and thrust bearings of the externally pressurized type eliminates problems of rubbing friction and bearing wear. The life of these bearings should be indefinite, it is said, and the speed of the shaft supported by the bearings is limited only to the strength of the material.

(For further information on "Miniature Helium Expansion Turbine," write National Bureau of Standards, Office of Technical Information, Washington 25, D. C.)

□ NAVY TESTS INFLATABLE CAUSEWAY: The Navy has been testing an inflatable causeway for delivering vehicles ashore during amphibious assault operations -- a floating roadway from an LST (Landing Ship, Tank) to the beach. A prototype designed by the Harco Engineering Company, Terminal Island, Calif. was tested and found to be too complex for military operations. However, Navy investigators concluded that the system, when developed, is feasible and can have many advantages.

(Report AD 259 335 by the U. S. Naval Civil Engineering Laboratory, Port Hueneme, Calif. is available through military channels or at $1.50 in photocopy from OTS, U. S. Department of Commerce, Washington 25, D. C.)

□ UNDERWATER RADIATION MONITOR: The Navy has developed a portable underwater radiation monitor to aid in protecting underwater demolition teams from radiation fields generated by nuclear debris. The battery-powered transistorized device is enclosed in a watertight stainless steel container. The detector is a 3/4 inch photomultiplier coupled to a thin plastic phosphor and mounted at the end of a 3-foot long probe. The signal produced by the interaction of gamma rays with the phosphor is amplified and passed to a hydrophone headset. The resulting audible click rate is proportional to the radiation intensity.

(R&D by C. F. Dohne and J. I. Hoover, Nucleonics Division, Radioactivity Branch, U. S. Naval Research Laboratory, Washington 25, D. C.)

□ TUNNEL DIODE STATIC INVERTER: The Navy has developed a simple static inverter circuit as part of its program for obtaining higher voltages from new power sources such as thermoelectric, thermionic and fuel cell generators. The circuit consists of two tunnel diodes and a transformer wound on a square loop magnetic core. The device has been found to be reliable and stable. Output is a high quality ac square wave, at any desired design voltage.

(Development by J. M. Marzolf, Electronics Division, Energy Conversion Branch, U. S. Naval Research Laboratory, Washington 25, D. C. Details to be available in the near future in NRL Report 5709 "Tunnel Diode Static Inverter.")

□ SOLAR POWERED NAVIGATION AID: The Coast Guard has found that solar-powered battery chargers can be used for certain of its navigation aids, but that present costs may be prohibitive. The system tested consisted of four watertight modules connected to sustain a 12-volt 1.35 ampere lamp load flashing on a one-tenth duty cycle. Coast Guard investigators estimate that solar power supplies would cost more than $10 per kilowatt-hour, while lead-acid batteries would cost some $3.70. It was concluded that "the present cost of solar modules does not justify their widespread use on shore-mounted minor lighted marine aids to navigation."

(For details see Report AD 259 675 available through military channels or at $1.60 in photocopy from OTS, U. S. Department of Commerce, Washington 25, D. C.)

PUBLICATION CHECKLIST

- ☐ SOVIET RADIO COMMUNICATION NETWORK, a massive review, from a wide variety of nonclassified Russian sources, on telecommunications, antennas, operations monitoring, space tracking systems, microwave radio relays and various types of equipment. Available for sale only in photocopy or microfilm. Detailed maps are included, but are difficult to decipher in photocopy version. 235 Pages. (Report AD 259 467, General Electric Company, Santa Barbara, Calif. available through military channels or at $16.50 in photocopy from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- ☐ TECHNICAL BOOKS AND MONOGRAPHS, a new edition of a valuable Atomic Energy Commission booklet describing works published or planned for publishing in the period 1947-1962. 52 Pages. Single Copies Free. (Write U. S. AEC Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tenn. for "Technical Books and Monographs")

- ☐ ACADEMIC AND INDUSTRIAL BASIC RESEARCH, the Proceedings of a 1960 conference, co-sponsored by the U. S. Government, and Princeton University. 87 Pages. 55 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. regarding Publication NSF 61-39)

- ☐ BERYLLIUM TECHNOLOGY, a review of developments in this field -- none of major importance -- during the period August through October, 1961. 4 Pages. Free to Government agencies, their contractors, subcontractors and suppliers. (Write Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio regarding DMIC Memorandum No. 138)

- ☐ SOVIET CHEMISTRY TODAY, a series of six lectures by V. I. Spitsyn of the USSR delivered during a visit to the U. S. Deals with such subjects as radiation of solids, radiochemistry, acids and Chelate Compounds. 302 Pages. $2.50. (Write Publications Office, National Academy of Sciences, Washington 25, D. C. for "Soviet Chemistry Today")

- ☐ CENTRAL INERTIAL GUIDANCE TEST FACILITY, a detailed report on the facilities, equipment and programs established by the Air Force at Holloman Air Force Base for the testing of inertial guidance systems. 80 Pages. (Publication AD 155 888 available through military channels or at $8.10 in photocopy from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- ☐ METHODS OF ANALYZING OILFIELD WATERS, a technical report on various methods which offer rapid, sensitive and precise means for determining major, minor and trace constituents of oilfield brines. 39 Pages. Single Copies Free. (Write Publication-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigations No. 5819)

- ☐ AMMONIA RESEARCH AND MASER DEVELOPMENT, a December, 1960 report, now available, on attempts by the Army Signal Corps to develop a Maser with useful military applications. This report describes preliminary work on a sealed-off vacuum system, on the design of molecular guns and focuser, and state separator. Work on a twin cavity ammonia beam device, generally discouraging, is also reviewed. 58 Pages. (Report AD 259 709 available through military channels or at $6.60 in photocopy from OTS, U. S.Department of Commerce, Washington 25, D. C.

- ☐ THE SUBMARINE, a Navy instruction manual covering virtually all phases of the submarine and its various systems. 212 Pages. $2.75. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for "The Submarine, Publication No. 68P")

- ☐ MINERAL ENGINEERING AND TECHNOLOGY REPORTS, a catalog of reports and reprints from one of the nation's leading educational institutions. (Write to the Publications Office, College of Mineral Industries, the Pennsylvania State University, University Park, Pennsylvania)